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Clinical Effects of Gu's Manipulation Combined with Functional Exercise After Endoscope Surgery for Knee Osteoarthropathy

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Abstract: To observe the effects of Gu's manipulation combined with progressive functional exercise method and simple progressive functional exercise method on the recovery of affected limb function after arthroscopic surgery for knee osteoarthropathy. Methods: A total of 98 patients with knee osteoarthropathy diagnosed in our department from January 2018 to January 2020 were randomly divided into simple progressive functional exercise method, the control group, with 49 cases of patients, and Gu's simple manipulation combined with progressive functional exercise method, the treatment group, with 49 cases of patients. Patients in both groups were routinely treated with subcutaneous arthroscopic dissection and meniscus trimming and suture with the ablation knife, and patients in both groups did not use external fixation after operation. The patients in the control group were given progressive functional exercise. In the manipulation group, the progressive functional exercise was combined with the guidance of simple manipulation therapy. Patients in both groups were discharged from the hospital on the 3rd day after surgery, and all received functional examination of the affected limb and knee WOMAC score on the 1st, 3rd, 7th, and 14th days after the surgery. Results: The comparison between the two groups showed that the patients in the treatment group had a significant reduction in pain 3 days after the surgery, swelling was significantly resolved, resting pain was improved, knee extension function and early walking stability were significantly improved; by the 14th day after surgery, the pain state of patients in the treatment group gradually tended to be consistent, but in the treatment group, the patients' walking state, points of up and down stairs and activity difficulty scores were better than those in the control group. Conclusion: Gu's simple manipulation combined with progressive functional exercise can greatly promote the swelling of the affected limbs and functional recovery after knee arthroscopy. It is significantly better than simple progressive functional exercise. It is easy to operate and easy for patients to master and operate by themselves, so it is worthy to be popularized in patients with undergoing knee arthroscopy.

Keywords: Degenerative Osteoarthropathy of the Knee, Arthroscopy, Postoperative Rehabilitation, Gu's Manipulation

1. Introduction

Among the knee osteoarthropathy, the incidence is higher in the elderly, especially in women. The aging process of society has promoted the increase in the incidence of this disease year by year. The disease has now become the primary cause of the elderly's exercise and chronic disability [1], and it has become the second largest disease after the ischemic heart disease leading to the loss of work ability. It refers to the degeneration and instability of the knee joint of the patient, which leads to the degeneration and structural disorder of the articular cartilage, accompanied by subchondral hyperostosis, cartilage exfoliation, and synovial inflammation, which gradually deforms the knee joint and eventually causes knee dysfunction. The disease involves not only the destruction of articular cartilage, but also the subchondral bone, ligaments, capsule,

synovium, and surrounding muscles of the entire joint, finally leading to degeneration and necrosis of articular cartilage and subchondral bone [2]. At present, our department has performed minimally invasive arthroscopic examination and cleansing for patients with moderate knee osteoarthropathy who have been confirmed by MRI to have cartilage exfoliation, meniscus injury, intercondylar osteophyte hyperplasia, and free body incarceration. However, arthroscopic surgery solves the state of intra-articular structural lesions, but fails to improve the local muscle state and circulatory state outside the joint quickly. It is difficult to quickly restore the balance of muscle strength around the joints. In addition, due to the fear of the patients after the surgery and the limitation of local activities, patients often face postoperative dysfunction and pain improvement process for a long time. In order to promote the faster recovery of knee function in patients, the manipulative treatment based on routine functional exercise after arthroscopy achieved good results, and the report is as follows.

2. Materials and Methods

2.1. General Information

Source of the patient: A total of 98 patients with knee osteoarthropathy definitely diagnosed in the Department of Orthopedics and Traumatology, Gushan Hospital, Zhoushan, Zhejiang Province from January 2018 to January 2020 were collected, with 44 males and 54 females; aged from 50 to 70 years old, with an average of 60.8 years old. Grouping method: 98 patients were randomly divided into two groups for single-blind treatment and control observation, 49 patients in the control group with simple progressive functional exercise and 49 patients in the treatment group with Gu's simple manipulation combined with progressive functional exercise.

2.2. Inclusion Criteria

1) The osteoarthritis classification criteria revised by the American college of rheumatology in 1995 [3]: (1) Knee pain for most of the last month; (2) X-ray film showing osteophyte formation; (3) Joint fluid examination showing consistent with osteoarthritis; (4) age ≥40 years old; (5) morning stiffness <30min; (6) bone sound when the joint is moving. Those satisfying (1) + (2) or (1) + (3) + (5) + (6), or (1) + (4) + (5) + (6). 2) Before surgery, the knee joint turned inward and outward less than 10°, and the flexion contracture (restricted extension) is less than 20°. 3) Preoperative MRI showed varying degrees of cartilage wear on the knee joint, osteophyte proliferation in the femoral intercondylar region, meniscus rupture, or incarceration of the free body in the relevant segment, and the above-mentioned lesions were confirmed under arthroscope.

2.3. Exclusion Criteria

1) Patients with locally infected wounds after the surgery. 2) Patients who are unable to cooperate and have mental disorders. 3) Patients who receive other physical therapy or acupuncture after the surgery. 4) Patients who influence observation and statistical results for other reasons [4].

2.4. Therapeutic Method

In both groups, the same physician performed conventional arthroscopic dissection under lumbar anesthesia. If the meniscus is in a state of wear and relaxation, the meniscus was trimmed and sutured with an ablation knife. If the free body was seen under the microscope, the meniscus was removed. If there is osteophyte compression and grinding of the cruciate ligament and meniscus, endoscopic excision is performed. All patients were not given continuous analgesic drugs after the surgery, and the lower limbs were restrained with elastic bandages for 12 hours, and no external fixation was used. After the surgery, patients were allowed to walk on the ground [5]. Patients in both groups were discharged on the third day after the surgery. The patients in the control group were given progressive functional exercise, while the patients in the treatment group were given Gu's simple manipulation exercise at the same time. The patients in both groups were prohibited from squatting and running and jumping with their knees bent more than 90° for 3 months.

Progressive functional exercise method for the affected limb 1) On the day of surgery: the patient will remain supine after the surgery, and the elastic bandage of the knee joint will be bandaged under pressure to prevent intra-articular hematoma and reduce pain; The elevation of the affected limb should be 15° above the level of the heart, which is conducive to venous and lymphatic reflux and reduces the swelling of the affected limb. After the anesthesia plane disappears, the movement of the toes and ankles is encouraged. 2) On the first day after the surgery postoperative: patients were asked to flex and extend the ankle joint in a full range, 30 times per group, 3 times per day; Contract the quadriceps equal length, tighten and hold for 5s, then relax for 2s, 30 times per group, 3 times per day; Isometric exercises of hamstring muscles, the lower leg of the affected side is high, and the heel is pressed down for 5 seconds to relax for 2 seconds, 30 times per group, 3 groups per day. Allow the patient to walk slowly with weight on the affected limb. If meniscus suture is performed, the knee bend should not be greater than 60°. 3) From the 2nd day to the 2nd week after the surgery, the stitches are removed: continue the pre-exercise, and carry out side-lift lower limbs and back-lift lower limb exercises, 30 times in each group, 3 groups per day; Bedside knee flexion and extension exercises were added. Patients sat at the bedside with their legs hanging down naturally, and stretched out their knees with active force. Then, the legs were relaxed to naturally hang down, with a range from small to large, and the quadriceps muscles were practiced for 20 min. Training walks alone, the affected limb gradually bears weight, strengthens weight-bearing and balance exercises. If meniscus suture is performed, the knee flexion should not be greater than 90°.

Gu's simple manipulation exercise method: the patients

operate by themselves, keeping the affected limb stretched and the muscles of the lower limbs relaxed, corresponding to the thumb of the same side and the other four fingers, starting from the upper 1/3 of the front of the quadriceps muscle, gradually lift the quadriceps muscle down to the patella, push the patella to the inside and outside three times, then massage the knees down, extend the joint gap between the two sides and massage to the collateral ligaments on both sides, and repeat the above movements for 3 times, and take the initiative to flex and extend the knee joint for 2 times. All the above actions are repeated 10 times as a group, 3 groups per day. Gu's manipulation therapy is performed after progressive functional exercise method.

2.5. Observation and Evaluation Indicators

Safety observation indicators 1) General physical examination items: including pulse, breathing, heart rate, blood pressure, etc., to evaluate the postoperative complications. 2) Knee joint mobility: due to the large difference in joint mobility before the surgery, patients with meniscus suture will partially restrict their knee flexion after the surgery, and the measurement objectiveness is low, so it is not used as the main evaluation indicator, but as a safety observation item. 3) Adverse reactions: including observation of infection, joint contracture, scar contracture, intra-articular hematoma.

The main observation indicators were performed on the 1, 3, 7, 14 days and 2 months after the surgery on the patient's pain status, swelling and clearing of the affected limb's suprapatellar sac, the functional test of mobility and the knee WOMAC [6] score were recorded. 1) Pain: recorded by visual scale scoring method. 2) Swelling: To determine the value of the upper circumference of the patella in the knee extension of the affected limb. 3) WOMAC score: refer to the Western Ontario and McMaster universities osteoarthritis knee osteoarthritis clinical evaluation index score.

2.6. Statistical Methods

The two groups were compared and analyzed. The counting data were tested by chi-square test. The measurement data conformed to the normal distribution by t test, and the homogeneity of variance test was conducted between groups, with $\alpha=0.05$ as the test level.

3. Results

3.1. Pain VAS Score

Data results showed that there was no significant difference in pain between patients in the two groups on the first day after surgery ($P>0.05$). On the 3rd and 7th days after surgery, the pain experience of the patients in the manipulation group was significantly improved, which was better than that of the control group ($P<0.02$). By the 14th day and 2 months after the surgery, the pain levels of patients in the two groups tended to be the same, but the treatment group still had an advantage over the control group (see Table 1).

Table 1. *Comparison of pain VAS scores between patients in the two groups.*

Groups	1st Day	3rd Day	7th Day	14th Day	2 months
control group	4.81±0.91	3.29±0.76	2.81±0.81	2.41±0.70	1.89±0.79
treatment group	4.59±1.01	3.01±0.89	2.40±0.69	2.21±0.59	1.75±0.80
t	-0.34	-2.19	-2.72	-1.61	-0.89
P value	0.565	0.031	0.011	0.121	0.361

3.2. Swelling

The results of the data showed that there was no significant difference in swelling between patients in the two groups on the first and third days after surgery ($P>0.05$). The swelling status of patients in the manipulation group on the 7th day after surgery was significantly improved, which was better than that of the control group ($P<0.01$). By the 14th day after surgery, the swelling data of patients in the treatment group was improved compared with the 7th day after surgery, while the swelling data of patients in the control group was significantly different from the 7th day after surgery ($P<0.05$). There was no significant difference in swelling data between patients in the two groups at 2 months after surgery (see Table 2).

Table 2. *Comparison of swelling scores between the two groups.*

Groups	1st Day	3rd Day	7th Day	14th Day	2 months
control group	40.59±1.71	40.51±1.61	39.89±1.61	39.59±1.58	38.89±1.47
treatment group	40.48±1.69	40.21±1.69	39.09±1.59	38.89±1.58	38.71±1.53
t	-0.29	-0.95	-2.69	-2.09	-1.02
P value	0.759	0.341	0.005	0.027	0.321

3.3. WOMAC Score

The results of the data showed that there was no significant difference in the total score of WOMAC between patients in the two groups on the 1st, 14th and 2 months days after the surgery, and there was a significant difference between patients in the two groups on the 3rd and 7th days after the surgery (see Table 3). The performance of the pain score in the WOMAC score was similar to the pain VAS score in patients in the two groups, so it is not listed separately; there

was no significant difference in the stiffness score between patients in the two groups; and the functional score was significantly different on the 3rd and 7th days after surgery. The score of patients in the treatment group was better than the control group (see Table 4). During the clinical observation period, patients in the treatment group reported that the joint pain of walking on the ground and resting state was significantly better than that of the control group; there was no significant difference in walking on the ground until the observation at 1 week and 2 months after the surgery, but the corresponding scores of going up and down the stairs in the patients of the treatment group were significantly better than the control group ($P<0.05$).

Table 3. *Comparison of WOMAC scores in patients in the two groups.*

Groups	1st Day	3rd Day	7th Day	14th Day	2 months
control group	45.31±7.03	40.45±7.37	35.07±7.49	26.51±7.98	14.12±5.09
treatment group	44.91±7.17	38.12±7.52	32.13±5.26	25.01±6.31	12.32±4.12
t	-0.89	-2.39	-2.73	-1.17	-1.58
P value	0.354	0.021	0.010	0.263	0.117

Table 4. *Comparison of functional scores in the WOMAC scores of the two groups.*

Groups	1st Day	3rd Day	7th Day	14th Day	2 months
control group	39.09±5.97	34.91±6.43	32.12±6.93	24.94±7.57	12.29±4.61
treatment group	38.51±5.56	32.47±6.39	27.93±4.81	23.12±5.94	11.21±3.92
t	-0.73	-1.97	-2.47	-1.43	-1.312
P value	0.497	0.029	0.026	0.294	0.091

4. Discussion

As a kind of minimally invasive surgery, knee arthroscopy is very popular because of its advantages of being intuitive, accurate, less invasive, quick recovery and simultaneous examination and treatment. The author believes that in the treatment of senile knee osteoarthropathy, arthroscopy and meniscus trimming and suture have certain advantages in restoring the inherent stability of the joint [7]. Especially in developing countries where the economic capacity of the whole population is not developed, this operation can improve the intra-articular environmental state, quickly and effectively reduce the pain of patients' active state, and can also provide a manual treatment and functional exercise for the subsequent operation. A smoother and safer joint foundation [8], which reduces the more serious wear and damage inside the joints caused by blind maneuvers and exercises, and creates good conditions for the integrated treatment of traditional Chinese and Western medicine in the later period; similarly, the author also believes that knee arthroscopy combined manipulation and functional exercise are the safety guarantee for muscular strength training in elderly patients with severe knee joints before arthroplasty. Of course, the integrated treatment of Chinese and western medicine combined with arthroscopic surgery also delayed the time of artificial knee replacement for some patients, reducing the risk of late revision surgery.

During the study, it was observed that the patient could perform Gu's simple manipulation after removing the elastic bandage the day after the operation. After the operation, the patient could feel obvious knee joint relaxation within 3 days and walk stably on the ground, and the feeling of local tension and fear of weight-bearing on the ground disappeared compared with the control group. Through continuous manipulation and functional exercise, the patient's knee joint activity and self-feeling were better than the control group. For the treatment of senile knee osteoarthritis after arthroscopy, the short-term and long-term efficacy of manipulation combined with functional exercise was significantly better than that of the simple exercise group.

A number of clinical studies have proved that Gu's simple manipulation of knee osteoarthropathy can effectively improve patients' pain and joint function. The author believes that the clinical effect of manipulation combined with functional exercise can be mainly reflected in the following aspects: 1) Improve local blood circulation, increase the supply of nutrients to muscles and nerves, eliminate local intra-bone venous stasis, reduce intra-bone pressure, and promote the absorption of local inflammatory tissues [9-11]. In clinical application, the author attaches particular importance to the manipulation treatment of the meridians and tendons of the affected limb, which can better promote the circulation of meridian qi and blood of the affected limb, eliminate the venous stasis of the affected limb, and block the pathological vicious cycle of the occurrence and development of osteoarthritis [12]. What the author advocates is Gu's traditional manipulation treatment, but this treatment is not conducive to the patient's self-operation after discharge. Therefore, the author simplified Gu's traditional manipulation treatment to the patient's own manipulation of quadriceps to the patella, pushing the patella to both sides and then massaging bilateral genu and eyes and lateral collateral ligament. 2) Manipulation combined with active functional exercise can enhance the role of cartilage tissue pumps, by promoting the penetration and diffusion of synovial fluid into articular cartilage, and at the same time improving the blood circulation of joint parts, thereby improving the nutrition and metabolism of articular cartilage and promoting the regeneration and repair of cartilage. 3) After arthroscopic surgery, manipulation combined with active exercise can play a role in dredging the tendons and

dredging the collaterals, slipping the joints and relieving muscle spasm, and induce central analgesia through nerve stimulation and reflex arc, which has a more lasting analgesic effect and non-toxic side effects [13]. 4) It can promote the recovery of quadriceps and hamstring muscle strength, improve the stability and functional state of the knee joint, restore or reconstruct the new mechanical balance, and reactivate the tendons and bones, so as to significantly improve the recovery of short-term joint function and consolidate the long-term efficacy.

5. Conclusion

The premise of the early simple manipulation combined with progressive functional exercise treatment is that the arthroscopic operation does not destroy the stability of the knee joint. The arthroscopic debridement of the knee osteoarthropathy is mainly to remove the free body in the joint, and the planed part hits the osteophyte, clean the damaged floating cartilage and repair the worn meniscus under the ion ablation knife. This type of surgery is mainly to improve the internal environment in the knee joint, maintain or reconstruct the stable state in the joint, and there is no large range of bleeding, so simple manipulation and functional exercise can be carried out at an early stage, without increasing intra-articular instability and bleeding tendency. We believe that it is worthy of promotion after minimally invasive arthroscopic treatment of knee osteoarthropathy.

In order to promote the regression of joint swelling and maintain the balance of muscle strength around the joint after knee arthroscopy, clinical methods can be used, such as manipulation [14], acupuncture, passive exercise of CPM machine [15], Chinese medicine fumigation and external application [16], etc. However, after long-term observation and practice, the author believes that even after the operation of knee cruciate ligament reconstruction, synovial dissection and other operations, the passive exercise of CPM machine and topical drugs are limited in the early state of proper knee joint protective fixation. However, patients can still be recommended to perform this manipulation under the condition of maintaining fixation in the early postoperative period. Early Gu's simple manipulation can promote the rapid dissipation of swelling, maintain the stability of quadriceps, and prevent the hypokinesia caused by postoperative fixation.

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